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opment, or that its growth was strongly marked at a very early date. How far it has increased in size over that of its non-human ancestor, we cannot judge from comparison with the brains of any existing apes, since these may be of a much lower grade of development. They are probably not fair standards of comparison. And if the body stood almost unchanged for ages, and all the influences of nature centered themselves upon the brain, a considerable increase in size and some variation in structure were inevitable consequences, and it is not easy to perceive, under the circumstances, that there is anything extraordinary in the special growth of the human brain.

In the making of man, then, we perceive the critical step that took the animal world over the dividing line between physical and mental evolution; and in human development we are concerned, not with the maturity of an old, but with the infancy of a new evolutionary process, which is full of far-reaching and extraordinary possibilities, of which the intellectual progress yet attained by man may be but the beginning. There may be needed as many millions of years for the full development of the mind as have been consumed in the evolution of the body, and the organ of the mind may yet attain an importance in the scheme of the physical organism of which we have no conception.

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# REVIEW OF THE PROGRESS OF NORTH AMERICAN INVERTEBRATE PALÆONTOLOGY FOR 1885.

BY J. B. MARCOU.

THE year which has just passed shows a marked increase in the number of palæontologic articles. The tendency to publish new species without any illustrations is also diminishing, and those interested in the science can look with great satisfaction on the augmented activity of North American invertebrate palæontology.

T. H. Aldrich gives "Notes on the Tertiary of Alabama and Mississippi, with descriptions of new species," and "Notes on Tertiary fossils, rare, or little known," in the Jour. Cincinnati Soc. Nat. Hist., Vol. VIII, pp. 145 and 153. "Observations upon the Tertiary of Alabama" appeared in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 300.

H. M. Ami has a "List of fossils from Ottawa and vicinity," and "Additional notes on the geology and palæontology of Ottawa and vicinity," in the Ottawa Field Naturalists' Club Trans., Nos. 5 and 6, Vol. II, p. 251.

Francis Bain and (Sir) J. W. Dawson have a joint paper, "Notes on the geology and fossil flora of Prince Edward island," in the *Canadian Rec. Sci.*, Vol. I, p. 154.

C. E. Beecher publishes a "List of the species of fossils from an exposure of the Utica slate and associated rocks within the limits of the city of Albany," in the 36th Rep. New York State Mus. Nat. Hist., p. 78.

W. R. Billings describes "Two new species of Crinoids," and gives the "Report of the palæontological branch" in the Ottawa Field Naturalists' Club Trans., No. 6, Vol. II, pp. 248 and 259.

N. L. Britton has an article on the discovery of "Cretaceous plants from Staten Island" in the Trans. N. Y. Acad. Sci., Vol. V, p. 28.

N. L. Britton and Arthur Hollick have an article on "Leaf-bearing sandstones on Staten Island, New York," in the Trans. N. Y. Acad. Sci., Vol. III, p. 30.

Charles Brongniart has "Les Insectes Fossiles des Terrains Primaires, Coup d'œil rapide sur la faune entomologique des terrains paléozoiques," in the Bulletin de la Société des Amis des Sciences Naturelles de Rouen, 3e serie, Vingt et unième année, 1er semestre, p. 50. This article was translated in the *Geol. Mag.*, new series, Dec. 3, Vol. II, p. 481.

R. E. Call writes "On the Quaternary and recent Mollusca of the Great basin, with descriptions of new forms;" this constitutes Bulletin 11 of the U. S. Geol. Survey.

P. H. Carpenter prints "Further remarks upon the morphology of the Blastoidea" in the *Ann. and Mag. Nat. Hist.*, 5th ser., Vol. XV, p. 277. This is an answer to and a criticism of Mr. G. Hambach's article entitled, "Contributions to the anatomy of the Pentremites, with descriptions of new species," in the Trans. St. Louis Acad. Sci., Vol. IV, p. 145.

J. M. Clarke gives "A brief outline of the geological succession in Ontario county, N. Y., to accompany a map," in the Report State Geologist for 1884, p. 9. In this he gives lists of fossils occurring in the different Devonian formations. Bulletin U. S. Geol. Survey, No. 16, is "On the higher Devonian faunas of Ontario county, New York."

E. W. Claypole has an article "On the vertical range of certain fossil species in Pennsylvania and New York" in the AMERICAN NATURALIST, Vol. XIX, p. 644.

J. C. Cooper has an article "On fossil and sub-fossil land shells of the United States, with notes on living species," published by the California Academy of Sciences, pp. 235–255.

W. H. Dall notices the "Miocene deposits in Florida" in *Science*, Vol. VI, p. 82. He has also "Notes on some Floridan land and fresh-water shells, with a revision of the Auriculacea of the Eastern United States," in Proc. U. S. Nat. Mus., Vol. VIII, p. 255. In Bulletin of the U. S. Geol. Survey, No. 24, is a "List of marine Mollusca, comprising the Quaternary fossils and recent forms from American localities between Cape Hatteras and Cape Roque, including the Bermudas."

J. D. Dana has a note on "Lower Silurian fossils at Canaan, N. Y.," in *Science*, Vol. VI, p. 283.

N. H. Darton has a "Preliminary notice of fossils in the Hudson River slates of the southern part of Orange county, N. Y., and elsewhere," in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 452.

G. M. Dawson, in the Bull. Chicago Acad. Sci., Vol. I, No. 6, p. 59, has an article entitled, "Boulder clays. On the microscopic structure of certain boulder clays and the organisms contained in them."

(Sir) J. W. Dawson has "On Rhizocarps in the Paleozoic period;" "Notes on *Eozoön canadense*;" "The Mesozoic floras of the Rocky Mountain region of Canada;" and "Ancient insects and scorpions," in the *Canadian Rec. Sci.*, Vol. I, pp. 19, 58, 141 and 207. He has also "A modern type of plant in the Cretaceous," and "A Jurasso-Cretaceous flora in the Rocky mountains," in *Science*, Vol. V, pp. 514 and 531. "The Cretaceous floras of Canada," in *Nature*, Vol. XXXIII, p. 32; and "Sir William Dawson on the Mesozoic floras of the Rocky Mountain region of Canada," in the AMERICAN NATURALIST, Vol. XIX, p. 609, are abstracts and notices published in advance from the author's essay "On the Mesozoic floras of the Rocky Mountain region of Canada," in the Trans. Roy. Soc. Canada, Vol. III, Sect. IV, p. 1.

S. W. Ford has a "Note on the age of the slaty and arenaceous rocks in the vicinity of Schenectady, Schenectady county, New York," in the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 397.

W. F. E. Gurley describes some "New Carboniferous fossils" in Bulletin No. 2 of his own series; no illustrations accompany these descriptions.

James Hall has published a large number of papers, some of which have appeared in limited editions in previous years, but they have not yet been noticed in these reviews. He publishes a "Note on the intimate relations of the Chemung group and Waverly sandstone in Northwestern Pennsylvania and Southwestern New York," and a "Note on the Eurypteridæ of the Devonian and Carboniferous formations of Pennsylvania, with a supplementary note on the *Stylonurus excelsior*," in the Proc. A. A. A. S., Vol. XXXIII, Part II, pp. 416 and 420. In the 2d Geol. Surv. Pennsylvania, Rep. of progress PPP, p. 23, he has a "Note on the Eurypteridæ of the Devonian and Carboniferous formations of Pennsylvania." In the Rep. State Geologist for 1881, p. 8, there is a "Classification of the Lamellibranchiata." In the Rep. State Geologist for 1882, p. 5, there is a "Discussion upon the manner of growth, variation of form and characters of the genus Fenestella, and its relations to Hemitrypa, Polypora, Retepora, Cryptopora, etc." This article is continued in the Rep. State Geologist for 1884, p. 35. Sixty-one photo-lithographed plates accompany the Rep. State Geologist for 1882. They are published in advance, with their explanations, under the following heads: "Fossil corals and Bryozoans of the Lower Helderberg group, and fossil Bryozoans of the Upper Helderberg group," p. 17, plates I–XXXIII, in advance of Vol. VI, Palæontology of New York; "Brachiopoda, plates and explanations," pls. XXXIV–LXI, in advance of Vol. IV, Part II, Palæontology of New York. In the Rep. State Geologist for 1883, p. 5, he gives a "Description of the Bryozoans of the Hamilton group (Fenestellidæ excepted)." The 35th Rep. New York State Mus. Nat. Hist. contains the following papers: "Notice of the machinery and methods of cutting specimens of rocks and fossils at the New York State Mus. Nat. Hist," p. 121; "Preliminary notice of the lamellibranchiate shells of the Upper Helderberg, Hamilton and Chemung groups, preparatory for the Palæontology of New York," Part I, p. 215; "Description of fossil corals from the Niagara and Upper Helderberg groups," p. 407; and "Illustrations of the microscopic structure of Brachiopoda," pl. XXII. The 36th Rep. New York State Mus. Nat. Hist., contains the following papers: "Bryozoa (Fenestellidæ) of the Hamilton group," p. 57; "On the structure of the shell in the genus Orthis," p. 73; "Description of a new species of Stylonurus from the Catskill group," p. 76; and "Description of a new genus from Greenfield, Saratoga county, N. Y.," pl. VI. The Rep. State Geologist for 1884 contains the following papers: "On the mode of growth and relations of the Fenestellidæ," p. 35, continued from p. 14 of the Rep. State Geologist for 1882; "On the relations of the genera Stictopora, Ptilodictya, Acrogenia and allied forms in the Palæozoic rocks of New York," p. 46; and "Note (on some Paleozoic pectenoid shells)," p. 47.

Angelo Heilprin has published a book entitled, "Town Geology: the lesson of the Philadelphia rocks. Studies of nature along the highways and among the byways of a metropolitan town;" plates IV and V contain figures of the Cretaceous invertebrate fauna. In *Science*, Vol. V, p. 475, and Vol. VI, p. 83, he has two notes on "The classification and palæontology of the U. S. Tertiary deposits;" these are criticisms of Dr. Otto Meyer's views.

E. W. Hilgard has two papers, one in *Science*, Vol. VI, p. 44, entitled, "The classification and palæontology of the U. S. Tertiary deposits;" and the other in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 266, entitled, "The old Tertiary of the Southwest;" both are criticisms of Dr. Otto Meyer's views.

G. J. Hinde has a "Description of a new species of Crinoids with articulating spines," in the *Annals and Magazine of Natural History*, 5th ser., Vol. XV, p. 157.

Alpheus Hyatt, in the Proc. A. A. A. S., Vol. XXXIII, Part II, pp. 490 and 492, publishes two notes, one on the "Structure of the siphon in the Endoceratidæ," and the other on the "Structure and affinities of Beatricea." He has a letter (relative to the Pteropods of the St. John group) in the Bull. Nat. Hist. Soc. New Brunswick, No. IV, p. 102. In the Proc. Boston Soc. Nat. Hist., Vol. XXIII, p. 45, he has published an elaborate discussion of the "Larval theory of the origin of cellular tissues."

J. F. James, in the Jour. Cincinnati Soc. Nat. Hist., Vol. VII, p. 151, has an article on the "Fucoids of the Cincinnati group." In the AMERICAN NATURALIST, Vol. XIX, p. 165, he has a note entitled, "Are there any fossil Algæ?" He has also, "Remarks on a supposed fossil fungus from the coal measures;" "Remarks on some markings of the rocks on the Cincinnati group, described under the names of Ormathicuus and Walcottia;" and "Remarks on the genera Lepidolites, Anomaloides, Ischadites and Receptaculites, from the Cincinnati group," in the Jour. Cincinnati Soc. Nat. Hist., Vol. VIII, pp. 157, 160 and 163.

A. A. Julien has "A study of *Eozoön canadense; filed* observations," in the Proc. A. A. A. S., Vol. XXXIII, Part II, p. 415.

G. F. Kunz has an article "On the agatized woods, and the Malachite, Azurite, etc., from Arizona," in the Trans. N. Y. Acad. Sci., Vol. V, p. 9.

Leo Lesquereux's "Contributions to the fossil flora of the Western Territories. Part III. The Cretaceous and Tertiary floras. Rep. U. S. Geol. Surv. Terr., F. V. Hayden, U. S. geologist in charge. 4to, Vol. VIII." Was not published till February, 1885, although it bears the imprint 1883.

A. H. Mackay publishes an article on the "Organic siliceous remains in the lake deposits of Nova Scotia," in the *Canadian Rec. Sci.*, Vol. I, p. 236.

Jules Marcou writes on "The Taconic system and its position in stratigraphic geology," in the Proc. Amer. Acad. of Arts and Sciences, new series, Vol. XII, p. 174.

J. B. Marcou records "Progress of North American invertebrate palæontology for 1884," in the AMERICAN NATURALIST, Vol. XIX, p. 353. This is a brief sketch of the palæontologic work done in the year; a more extended review of it is published in the Smithsonian report for 1884, No. 610, pp. 1–20, Washington, 1885. In the Proc. U. S. National Museum, Vol. VIII, p. 290, he has "A list of the Mesozoic and Cenozoic types in the collections of the U. S. Nat. Museum;" and the "Identification of certain fossils and strata of the Great Sioux Reservation" (in "The Lignites of the Great Sioux Reservation, a report on the region between the Grand and Moreau rivers, Dakota," by Bailey Willis, Bull. U. S. Geol. Sur., No. 21, p. 11).

G. F. Matthew has "Recent discoveries in the St. John group," and "A new genus of Cambrian Pteropods," in the *Canadian Rec. Sci.*, Vol. I, pp. 136 and 152. In the Bull. Nat. Hist. Soc. New Brunswick, No. IV, p. 97, he has "An outline of recent discoveries in the St. John group. With a letter of Professor Alpheus Hyatt relative to the Pteropods." In the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 72, he has a note "On the probable occurrence of the great Welsh Paradoxides, *P. davidis*, in America." In the same volume, p. 293, he has a "Notice of a new genus of Pteropods from the St. John group (Cambrian)." In this he describes the genus Diplotheca. He has a "Note on the genus Stenotheca" in the *Geol. Mag.*, new series, Decade III, Vol. II, p. 425. In the Trans. Roy. Soc. Canada, Vol. II, Sec. IV, p. 99, appear his "Illustrations of the fauna of the St. John group continued; and a paper on the Conocoryphea, with further remarks on Paradoxides."

Charles Morris, in the Proc. Acad. Nat. Sci. Philada. for 1885, pp. 97 and 385, has two articles entitled, "The primary conditions of fossilization," and "Attack and defense as agents in animal evolution."

Otto Meyer, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 457, and Vol. XXX, pp. 60 and 421, has an article in three parts, entitled "The genealogy and the age of the species in the southern old Tertiary." The author assumes the extraordinary position that the succession is just the contrary from what it has hitherto been considered to be, the Vicksburg, according to him, being the oldest and the Claiborne the most recent formation. In "Part I. The geological relations of the species," he partially describes a number of species and varieties, without any illustrations; these he considers to be new. Part II is on "The age of the Vicksburg and the Jackson beds." Part III, "Reply to criticisms." The author defends his views against the criticisms of E. W. Hilgard, E. A. Smith and T. H. Aldrich, in the October number of the *Amer. Jour. Sci.* In *Science*, Vol. V, p. 516, and Vol. VI, p. 143, he has two notes on Angelo Heilprin's criticism of his work.

J. S. Newberry, in the Ann. N. Y. Acad. Sci., Vol. III, p. 217, has a "Description of some peculiar screw-like fossils from the Chemung rocks." They are also described in the Trans. N. Y. Acad. Sci., Vol. III, p. 33.

H. A. Nicholson and Robert Etheridge, Jr., in the *Geol. Mag.*, new series, Decade III, Vol. II, p. 529, have an article "On the synonymy, structure and geological distribution of *Solenoptera compacta* Billings sp."

H. A. Nicholson and A. H. Foord, in the *Ann. and Mag. Nat. Hist.*, 5th ser., Vol. XVI, p. 496, have an article "On the genus Fistulipora McCoy, with descriptions of several species."

A. S. Packard, in the AMERICAN NATURALIST, Vol. XIX, pp. 291, 700, 790 and 880, has the following articles: "Types of Carboniferous Xiphosura new to North America;" "The Syncarida, a group of Carboniferous Crustacea;" "On the Gampsonychidæ, an undescribed family of fossil schizopod Crustacea;" "On the Anthracaridæ, a family of macrurous decapod Carboniferous Crustacea, allied to the Eryonidæ."

B. N. Peach, in *Nature*, Vol. XXXI, p. 295, has "Ancient air-breathers;" a general review of Paleozoic scorpions.

J. H. Perry, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 157, has a "Note on a fossil coal plant found at the graphite deposit in mica-schist at Worcester, Mass."

Julius Pohlman and R. P. Whitfield, in *Science*, Vol. VI, p. 183, have a note on "An American Silurian scorpion."

A reprint of geological reports and other papers on the geology of the Virginias, by the late William Barton Rogers, has been issued.

S. H. Scudder publishes "The geological history of Myriopods and Arachnids. Eighth annual address of the retiring president of the Cambridge Entomological Club," in *Psyche*, Vol. IV, January–March, 1885, p. 245. In the Mem. Nat. Acad. Sci., Vol. III, p. 1, he has a "Description of an articulate of doubtful relationship from the Tertiary beds of Florissant, Colorado." In the Proc. Acad. Nat. Sci. Philada. for 1885, pp. 34 and 105, he has "New genera and species of fossil cockroaches from the older American rocks;" and "Notes on Mesozoic cockroaches." In the AMERICAN NATURALIST, Vol. XIX, p. 876, is an abstract of his paper on the "Relations of the Paleozoic insects."

H. M. Seeley, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 355, describes "A new genus of chazy sponges, Strephochetus."

E. A. Smith, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 270, has "Remarks on a paper of Dr. Otto Meyer on 'Species in the southern old Tertiary.'"

C. Wachsmuth and W. H. Barris have "Descriptions of new Crinoids and Blastoids from the Hamilton group of Iowa and Michigan."

C. Wachsmuth and Frank Springer issue a "Revision of the Palæocrinoidea. Part III. Discussion of the classification and relations of the brachiate Crinoids, and conclusion of the generic descriptions," in the Proc. Acad. Nat. Sci. Philada. for 1885, p. 225.

C. D. Walcott has a "Description of the (Deer creek, Arizona) coalfield," Senate Ex. Doc. No. 20, 48th Congress, second session, Appendix I, p. 5. He contributes the following papers to the *Amer. Jour. Sci.*, 3d ser., Vol. XIX, pp. 114 and 328, and in Vol. XXX, p. 17, "Palæontologic notes;" "Paleozoic notes, new genus of Cambrian Trilobites, Mesonacis;" and "Note on some Paleozoic Pteropods."

L. F. Ward, in the *Botanical Gazette*, Vol. IX, p. 169, has "The fossil flora of the globe." In the Proc. A. A. A. S., Vol. XXXIII, Part II, pp. 493, 495 and 496, he has "Historical view of the fossil flora of the globe;" "Geological view of the fossil flora of the globe;" and "Botanical view of the fossil flora of the globe." In the AMERICAN NATURALIST, Vol. XIX, pp. 637 and 745, he has an article on "Evolution in the vegetable kingdom."

C. A. White has "The application of biology to geological history, a presidential address delivered at the fifth anniversary meeting of the Biological Society of Washington, January 24, 1885," in the Proc. Biol. Soc. Washington, Vol. III, p. I. In the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, pp. 228 and 277, he has "Notes on the Jurassic strata of North America;" and "The genus Pyrgulifera Meek, and its associates and congeners." Bull. U. S. Geol. Surv., No. 15, is "On the Mesozoic and Cenozoic palæontology of California." Bull. U. S. Geol. Surv., No. 18, is "On marine Eocene, fresh-water Eocene and other fossil Mollusca of Western North America;" it is divided into three parts: I. The occurrence of *Cardita planicosta* Lamarck, in Western Oregon; II. Fossil Mollusca from the John Day group in Eastern Oregon; III. Supplementary notes on the non-marine fossil Mollusca of North America. Some additions and corrections for the illustrations on p. 19 are made to the above work. Bull. U. S. Geol. Surv., No. 22, is "On new Cretaceous fossils from California."

J. F. Whiteaves has a "Report on the Invertebrata of the Laramie and Cretaceous rocks of the vicinity of the Bow and Belly rivers and adjacent localities in the Northwest Territory" in the Geol. and Nat. Hist. Surv. Canada, A. R. C. Selwyn, director; Contribution to Canadian palæontology, Vol. I, Part I. In the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 444, he has "Notes on the possible age of some of the Mesozoic rocks of the Queen Charlotte islands and British Columbia." In the Trans. Roy. Soc. Canada, Vol. II, pp. 237 and 239, he has "Description of a new species of Ammonite from the Cretaceous rocks of Fort St. John, on the Peace river," and "Note on a decapod Crustacean from the Upper Cretaceous of Highwood river, Alberta, N. W. T."

R. P. Whitfield contributes to *Science*, Vol. VI, p. 87, "An American Silurian scorpion." In the Bull. Amer. Mus. Nat. Hist., October 10, 1885, Vol. I, No. 6, pp. 181, 191 and 193, he has the following articles: "On a fossil scorpion from the Silurian rocks of America;" "Notice of a new Cephalopod from the Niagara rocks of Indiana;" "Notice of a very large species of Homalonotus from the Oriskany sandstone formation."

H. S. Williams, in the Proc. A. A. A. S., Vol. XXXIII, Part II, p. 422, publishes an article on "Geographical and physical conditions as modifying fossil faunas." In the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 45, he has a "Notice of a new limuloid Crustacean from the Devonian."

A. Winchell, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, pp. 316 and 317, has "Notices of N. H. Winchell on Lingula and Paradoxides from the red quartzites of Minnesota," and "On Cœnostroma and Idiostroma and the comprehensive character of Stromatoporoids."

N. H. Winchell describes "Fossils from the red quartzites at Pipestone" in the Geol. and Nat. Hist. Surv. Minnesota, 13th Ann. Rep., p. 65.

H. H. Winwood, in the *Geol. Mag.*, new series, Decade III, Vol. II, p. 240, remarks on the "Geological age of the Rocky mountains;" in it he reports finding a Menevian fauna between the 116th and 117th parallels of longitude on the Canadian Pacific railway.

B. H. Wright, in the 35th Rep. N. Y. State Mus. Nat. Hist., p. 195, contributes "Notes on the geology of Yates county, N. Y."

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# GRAVITATION AND THE SOARING BIRDS.

BY I. LANCASTER.

"IN experimental philosophy, all propositions collected by induction from phenomena are to be held either exactly or approximately true until other phenomena are found by which those propositions can be made either more accurate or subject to exceptions" (Newton's Principia, Book III).

The soaring birds seem to be excused from obedience to the laws determining the actions of other inert bodies heavier than